Electric Vehicles and Ethical Consumption: An Experimental Study on the Effects of Socio-Environmental Cost Information on Attitudes Towards Electric Mobility and Political Engagement

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Abstract

The present thesis is concerned with the effects of information about the socio-environmental costs of electric vehicle production on positive attitudes towards electric vehicles, and political engagement intention. To answer this question, an online experiment (n=229) was conducted in Norway. Participants were randomly assigned a treatment with varying amounts of information (with solutions vs. without solutions) about the socio-environmental consequences of lithium extraction in Chile. Additionally, two different framings for the solutions were used (technological vs. political), thus resulting in four groups in total. The effect of the treatment on the dependent variables (i.e., positive attitudes towards electric vehicles, support for policies encouraging electric vehicle adoption, and willingness to be politically engaged) is tested by using twelve multiple linear models. Null-hypotheses could not be rejected. However, unexpected findings suggest that cosmopolitan, justice, and environmental attitudes, as well as having environmental motivations for electric vehicle are positively associated with political engagement intention. A paradoxical, yet not significant, effect of information on political engagement intentions was also found. Overall, these unexpected results are useful for informing future research in the field.

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1 Introduction

Warnings about climate change are far from new. Now, as the environmental crisis intensifies and its consequences are increasingly felt around the world, greater efforts are being made to tackle the problem. An important part of the initiatives aimed at fostering more sustainable societies is targeted towards our current mobility system. The priority that this sector has been given is hardly surprising given its significant share in the global greenhouse emissions (GHE). According to the European Commission, transportation represented one quarter of EU's GHE in 2019 (2019). To face this issue, the European Union (EU) has expressed its ambition to have at least 30 million electric vehicles in circulation by 2030 (European Commission, n.d.) as part of their strategy to achieve carbon neutrality by 2050 (European Commission 2019). With the same intention of eliminating net GHE by 2050, Japan aims at having all new passenger cars be electric by 2030 (IEA 2021). Similarly, in 2021, President Biden expressed his commitment to having half of the new vehicles be electric by 2030 (The White House 2021). Other countries such as Canada, Chile, India, and New Zealand have also adopted policies for encouraging the adoption of electric vehicles (IEA 2021).

This international move towards electric mobility can be explained by the benefits of electric vehicles, which are often brought up to encourage their adoption. These go from the reduction of 50 to 60% of GHE –given the electricity sources used by the EU– (Holden et al. 2020), to health benefits due to the decrease of air and noise pollution (Biresselioglu, Demirbag Kaplan, and Yilmaz 2018). However, with the excitement of having found promising environmental solutions, the trade-offs of these new technologies are seldom taken into account by the technical framing usually adopted by politicians and policymakers (Healy and Barry 2017; Di Felice, Renner, and Giampietro 2021). Several ethical and environmental issues have been identified along the electric vehicle supply chain (Benjamin K. Sovacool et al. 2021). Nevertheless, these problems tend to be far removed from the consumers (Healy and Barry 2017; Liu et al. 2022), as electric vehicles are mostly bought and used in wealthy countries, but the negative consequences are carried mostly by developing countries in the Global South (IRP 2020; Benjamin K. Sovacool et al. 2021; Liu et al. 2022). Therefore, it is not surprising that consumers tend to be unaware of the social and environmental costs of electric vehicle production (Liu et al.

2022).

If the goal of green transitions is achieving not only sustainable, but also fair societies, the negative side of electric mobility should be addressed. However, this concern hardly finds place in official political agendas, given the usual "techno-optimistic" approach taken by most governments and policymakers (Renner and Giampietro 2020; Di Felice, Renner, and Giampietro 2021). In this situation, it is important to remember that consumers can also be political agents, even more so in times of social media (Liu et al. 2022). Cases in which consumer pressure has resulted in new regulations and a change in business practices can be found in a wide range of industries (Ethical Consumer 2022). In the case of electric vehicles, communities directly affected by extractive activities have raised their voice about the situation (Sherwood 2019). Nevertheless, these initiatives are not common among actual and potential electric vehicle consumers. Could the absence of the "ethical electric vehicle consumer" be due to the lack of awareness of the negative impacts along the electric vehicle supply chain?

This thesis aims at providing answers to that question. More precisely, the main research question articulating the study is "does information about the socio-environmental costs of electric vehicle battery production decrease positive attitudes towards electric vehicles and increase willingness to be politically engaged?" Additionally, I am interested in exploring whether the way in which that information is communicated makes any difference on such information's effect. To answer these questions, I conducted an online experiment in Norway, country known for its high percentage of electric vehicles. Participants were randomly assigned to four different groups, which received varied amounts of information about the social and environmental damage caused by lithium extraction in Chile. The effect of this information and the different framings used were later analyzed by using twelve multiple linear regression models.

Finally, it is important to clarify that my intention is not to oppose the transition to a more sustainable transportation system. On the contrary, I believe that it is a crucial step in our struggle against climate change. However, such an important step should be taken without overlooking its negative implications. Understanding how consumers' attitudes towards electric vehicles change in the face of troubling information about how they are produced is relevant for all the actors working to move electric mobility forward, including politicians, businesses, and activists.

This is the case because both electric vehicle sales, and the implementation of successful electric mobility policies depend heavily on the population's attitudes about electric vehicles. On the other hand, an assessment of the effectiveness of information for triggering reflection and political engagement could be useful for informing the strategies of political activists advocating for environmental justice. Finally, this research contributes to the efforts of academics and activists working for the visibilization of the problematic sides of the environmental solutions, and further includes consumers/citizens as relevant actors in the pathway to fairer sustainability policies.

2 Literature Review

Not surprisingly, most of the existing literature on electric vehicles has focused on figuring out how to encourage their adoption. Therefore, the factors that prevent (or persuade) consumers from buying electric vehicles has been a major theme in the field. For example, Wu et.al. (2019) found a strong indirect influence of environmental concerns on Chinese people's willingness to use autonomous electric vehicles. Authors have also highlighted predictors such as age, gender, income level, and number of children (Chen et al. 2020), environmental and technological attitudes (Priessner, Sposato, and Hampl 2018), moral beliefs (Milchram et al. 2018), and psychological factors and knowledge (Simsekoglu and Nayum 2019). Like these studies, my thesis is also concerned with consumers' attitudes towards electric vehicles. Nevertheless, it diverges from them in that my research question has been informed by current developments in the fields of environmental and energy justice.

Despite prevalent optimism that surrounds them, the negative side of electric vehicles is receiving increased attention. Some authors have called the attention to the injustices that arise as consequence of the low-carbon transition, among them, those present in the different stages of the electric vehicle supply chain (Benjamin K. Sovacool et al. 2021). An issue which is commonly highlighted by justice-related criticisms refers to the socio-environmental impacts of mineral extraction related to lithium, cobalt, and other resources needed for electric batteries (Heffron 2020). For example, Church and Crawford (2020) assess how the transition to low-carbon economies can affect violence and conflict dynamics in states rich in "transition minerals". Similarly, Nem Singh has criticized the unjust situation of developing countries as "the new battlefield for resource extraction between China and the West" (Singh 2021, 13).

In addition to justice-centered studies, other critical scholars have emphasized the ambivalent potential of electric mobilization as an environmental solution. Bahmonde-Birke's (Bahamonde-Birke et al. 2020) criticizes the sustainability of electric mobility by warning that a mere replacement of conventional vehicles with electric vehicles under our current conditions could lead to increased CO2 emissions. Together with those mentioned in the previous paragraph, most of these studies share a more systemic approach, which pays attention to the way in which the proliferation of electric vehicles –and other renewable energy solutions– might impact other populations and ecosystems, as well as be counterproductive for developed countries' sustainability goals (Benjamin K. Sovacool et al. 2019; Agusdinata, Eakin, and Liu 2021).

Several of these studies are inspired by debates on environmental justice, field from which the more precise concept "energy justice" has emerged. As a more specific issue within environmental justice, energy justice addresses the dissemination of costs, the distribution of benefits, and the decision-making procedures that follow from the energy system (Benjamin K. Sovacool 2016). Moreover, Benjamin Sovacool (2016) has identified the distributive, procedural, global, and recognition dimensions of energy justice demands. Kirsten Jenkins (Jenkins 2018) has contributed further to achieving a clearer delimitation of the concept, as well as to the justification of its use by differentiating it from the notions of environmental, and climate justice. Taking a different direction, Darren McCauley and Raphael Heffron (2018) bring together the concepts of climate, energy, and environmental justice to present "just transition" as a framework that promotes distributional, procedural, and restorative justice under the societal changes that sustainability requires. This literature touches upon the wide range of instances in which the transition to renewable energies is relevant. The study of the implications of electric mobility falls within this problem, as it entails the replacement of fossil fuel powered vehicles.

Given the existence of critical approaches to electric mobility, and the considerable amount of research on electric vehicle adoption, it is surprising that studies from the perspective of ethical consumption remain largely absent from the literature on electric mobility. Fields like marketing and business have been interested in the influence of moral concerns in consumer behavior, being De Pelsmacker, Driesen, and Rayp's -(De Pelsmacker, Driesen, and Rayp 2005) study about people's willingness to pay for fair-trade coffee a well-known example. Traditionally, consumer behavior has not been an issue of interest of political scientist. However, researchers are increasingly calling attention to the ways in which consumers can engage in politically relevant activities (Liu et al. 2022). As an intersection between politics (i.e., environmental policies), business (i.e., car manufacturers), and individual agents (i.e., citizens/consumers), electric mobility offers a good case for exploring these dynamics. Nevertheless, the question about how information about the externalities along the electric vehicle supply chain influences consumers' attitudes towards electric mobility has only been directly addressed by Liu et.al. (2022). Using the online platform "Reddit", the researchers recruited electric vehicle users with different motivations to drive them, and later asked them to evaluate and express their agreement with statements about the socio-environmental costs of electric vehicle production (Liu et al. 2022). From this, they were able to identify a lack of awareness about those negative consequences, and that information about these issues is likely to impact users' perceptions about electric vehicles (Liu et al. 2022).

This thesis builds on Liu et.al.'s (2022) recent findings. However, it intends to contribute to the growing literature on critical approaches to electric mobility. First, in contrast to Liu et.al.'s (2022) study, my experiment will be conducted in Norway, a leading country in electric vehicle adoption. With a strong history of electric vehicle incentives, different cultural values, and a successful implementation of electric vehicle infrastructure, the Norwegian population might be more (or less) resilient towards information about the negative impacts of electric vehicle production. Second, the treatments used in this study include different amounts of information, as well as different framings. This adds yet another layer to the question already explored by Liu et.al.(2022), layer which is useful given that knowing which frames are more likely to foster people's support and which are not is key for effectively communicating environmental issues (Hall 2013). Finally, by discussing potential improvements in the data collection process and suggesting alternative ways forward, my thesis will hopefully encourage further experimental research in this incipiently explored area.

3 Theory and Hypotheses

3.1 Main Hypotheses

Nowadays, outsourcing production is a common business practice (Egels-Zandén and Hansson 2016). Consequently, supply chains have become increasingly fragmented and geographically dispersed (Egels-Zandén and Hansson 2016). However, despite the economic benefits of globalized supply chains, accountability and transparency issues arise from them, impacting both companies and consumers. The complexity that some supply chains have developed makes it difficult for firms to keep track of all the providers involved in the production chain, as well as the conditions in which each of those providers operate (Egels-Zandén and Hansson 2016). In turn, reduced traceability and lack of transparency (be it intentional or not), increases information asymmetry, situation which is already fairly common for consumers (Andorfer and Liebe 2015). The production chain of electric vehicles is no exception. As Liu et.al.'s (2022) research shows, electric vehicle users tend to be unaware of the negative consequences of electric vehicle production. This is further motivated by the geographical distance between the countries in which electric vehicles are widely used and those in which extraction and manufacturing take place (Agusdinata, Eakin, and Liu 2021; Benjamin K. Sovacool et al. 2021; Liu et al. 2022).

Consumers from industrialized countries are increasingly concerned about values such as justice and sustainability. However, for consumers to prefer ethical or sustainable products, they need to realize that a given conventional good has problematic implications (Hudson, Hudson, and Edgerton 2013). Without enough information about the conditions under production takes place, this is realization is highly unlikely. Therefore, this study hypothesizes that providing information about the socio-environmental costs of electric vehicle battery production can lead to the questioning of the advantages of electric mobility. In other words, this new information would lead to a change in positive attitudes towards electric vehicles, which include individual electric vehicle use and related nation-wide policies. Thus, the following hypotheses will be tested:

H1: Information about the socio-environmental costs of electric vehicle battery production decreases positive attitudes towards electric vehicle use

H2: Information about the socio-environmental costs of electric vehicle battery

Dependent variable	Sub-hypothesis
DV1: Positive attitudes towards EV use	*For EV users, information about the socio-environmental costs of EV battery production decreases satisfaction with their main means of transportation. The opposite effect is expected for users of other means of transportation*
	For EV users, information about the socio-environmental costs of EV battery production increases willingness to change their main means of transportation. The opposite effect is expected for users of other means of transportation.
	Information about the socio-environmental costs of EV battery production decreases the ikelihood of recommending a friend to get an EV.
DV2: Support for policies encouraging EV adoption	*Information about the socio-environmental costs of EV battery production decreases the likelihood of voting for a party that stands for policies which make EVs cheaper to buy.*
	Information about the socio-environmental costs of EV battery production increases the likelihood of voting for a party that stands for policies that require EV producers to give information about the origin of their supplies
	Information about the socio-environmental costs of EV battery production decreases the likelihood of voting for a party that stands for subsidizing the price of public transportation tickets instead of incentives that make EVs cheaper to buy.

Table 1: Sub-hypotheses for DV1 and DV2

production decreases support for policies encouraging electric vehicle adoption

More than one measurement is used for each of these dependent variables (i.e., positive attitudes towards electric vehicle use, and support for policies encouraging electric vehicle adoption). Therefore, *H1* and *H2* are divided in sub-hypotheses that correspond to the measurements for each dependent variable. Table 1 shows the sub-hypotheses for each dependent variable.

As research such as Lu's (2021) has shown, emotions such as moral outrage, distress, and compassion are important for understanding the intention to participate in collective action. Outside of academic research, the mobilizing power of indignation can be seen in the multiple. The socio-environmental costs of electric vehicle battery production has been addressed by fields such as environmental and energy precisely because they are carried by populations which do not directly enjoy the benefits of electric mobility. Therefore, information about this issue may trigger feelings of compassion or moral outrage, which are known to encourage political mobilization (2021). Therefore, the third hypothesis is:

H3: Information about the socio-environmental costs of electric vehicle battery production increase willingness to be politically engaged

This dependent variable will be measured as the respondent's willingness to participate in activities which are commonly associated with being politically active. These are 1) learning more about the production of electric vehicles, 2) joining a protest against the destruction of natural ecosystems around the world, 3) donating money to an organization working against the destruction of natural ecosystems around the world, and 4) volunteering for an organization working for the same cause. It is expected that information about the socio-environmental costs of electric vehicle battery production will *increase* the willingness to learn more about the production of electric vehicles, as well as to participate in a protest, donate money, and do volunteer work for an an organization working against the destruction of natural ecosystems around the world.

3.2 Additional Hypotheses

Additionally to the effects of information, it is interesting to assess whether the way in which this information is communicated can make any difference on how consumers react to it. White, MacDonnell, and Ellard (2012) have argued that, rather than the knowledge of an injustice having been committed in itself, "justice restoration potential" plays a central role in encouraging ethical consumption behavior. This is because, without the feeling that their actions can make a contribution in redressing the situation, consumers are more likely to distance themselves from the problem (2012). This is similar to the arguments that refer to the concept of "perceived consumer effectiveness" (PCE), which accounts for the consumer's subjective belief of their ability to achieve their desired outcome (Kang, Liu, and Kim 2013; Hanss and Doran 2020). Like the concept of "justice restoration potential" for fair-trade consumption (2012), PCE has been considered as the bridge between environmental concerns and pro-environmental behavior (Roberts 1996; Kang, Liu, and Kim 2013). This suggests that, to induce a change in attitudes -and, consequently, a potential change in behavior-, the information should also convey that the problem caused by electric vehicle battery production can be addressed. Therefore, an additional hypothesis is:

H4: The effect of information about the socio-environmental costs of electric vehicle production on positive attitudes towards electric vehicle use, support for policies encouraging electric vehicle adoption, and willingness to be politically engage are stronger when solutions are explicitly solutions.

Finally, another aspect which might be relevant when communicating new information is the framing. By using specific frames, the media and politicians provide "certain dimensions of the complex issue with greater apparent relevance than they would have under an alternative frame" (Nisbet 2009, 16–17). This is relevant to understand people's thoughts and feelings about a specific issue, as frames work as "interpretative shortcuts" (Nisbet 2009, 17) that allow us to make sense of what is being communicated (Hall 2013). Thus, it is reasonable to expect that "changes in how people think and feel about a situation depend in turn on changes in the frameworks they use to interpret that situation and the stories they tell each other about it" (Hall 2013, 126).

The development of new sustainable technologies is usually presented by politicians as the solution to the environmental crisis Di Felice, Renner, and Giampietro (2021). From this perspective, the hopes of addressing current and future problems rely heavily on scientific innovations. Nevertheless, this "techno-optimistic" framing tends to obscure that sustainability is not a mere technological issue. Rather, finding environmental solutions involves questions about how to implement these new technologies, who is going to benefit, and who is going to carry the costs (Gonella et al. 2019). This means that the transition to renewable energies will require deep and structural social changes Renner and Giampietro (2020), which necessarily involve "issues of power, distribution of and access to resources, political economy, and so on" (Healy and Barry 2017, 452). Therefore, as an environmental solution, electric mobility can be address both from a political or from a technological approach.

Considering the concepts of PCE and "justice restoration potential", it is possible to assume that framings which give consumers a stronger feeling of being able to contribute are more likely to lead to attitude change, and political engagement intention. Given that technological development is in hands of scientists, a technological framing of the solutions to the negative impacts caused by electric vehicle battery production is not likely to give a strong sense of PCE. On the contrary, a political framing which emphasizes the role of consumers and citizens as agents of change is more likely to convey the idea that common individuals can also contribute to fair and sustainable societies. Therefore, the last additional hypothesis is:

> *H5: Compared to a technological framing, a political framing of the solutions make the effects of information about the socio-environmental costs of electric vehicle production stronger on positive attitudes towards electric vehicle use, support for policies encouraging electric vehicle adoption, and willingness to be politically engage are stronger when solutions are explicitly solutions*

4 Research Design

This study was designed as a randomized control trial (RTC). This design was chosen because randomization provides strong grounds for causal inference (Kalaian 2008). Additionally, RTC's advantages for understanding how people process and respond to new information has been acknowledged (Kosicki 2008). The experiment was carried out in Norway, given their high amount of electric vehicles and the existence of strong economic incentives for electric vehicle adoption.

The effect of information about the socio-environmental costs of electric vehicle battery production on positive attitudes towards electric vehicle use, support for policies aimed at encouraging electric vehicle adoption, and willingness to be politically engaged was tested by randomly assigning three different treatments. This resulted in four groups, including the control group. The treatments were texts with information about the negative social and environmental consequences of lithium mining in Chile. However, they varied on the inclusion and framing of solutions.

The questionnaire was created with the online survey tool *Qualtrics*, published in Norwegian, and distributed on Facebook and Reddit, targeting people living in major Norwegian cities. The data collection process took place between May 26th and 30th. Then, the data was cleaned and analyzed with *R-Studio*, using twelve multiple linear regression models.

4.1 The Norwegian Case

Norway was chosen as the place to do this experimental study, because it has been consistently considered a prime example of a successful (ongoing) transition to electric mobility over the last decades (Ryghaug and Toftaker 2016). According to the Norwegian Electric Vehicle Association (2022), the market share for electric vehicles in December 2021 was 67%, having reached a record-breaking 77.5% in the same year. Moreover, by February 2022, Norway had more than 470 000 registered electric battery cars (Norwegian Electric Vehicle Association 2022). Like other countries committed to sustainable development goals, the Norwegian Parliament aspires have all new cars sold by 2025 be emission free (Norwegian Electric Vehicle Association 2022). The surprising progress in the diffusion of electric vehicles in Norway gives reason to believe that this goal is likely to be achieved.

For the Norwegian Electric Vehicle Association, "the Norwegian success story is first and foremost due to a substantial package of incentives developed to promote zero-emission vehicles into the market"(2022). These incentives include the exemption from sales and value-added taxes (VAT), road tolls and tunnel-use fees, cheaper ferry prices, and public parking which might include free charging (Ryghaug and Skjølsvold 2019). Additionally, given their high percentage of hydropower generated energy, the cost of electricity in Norway is considerably lower than petrol, which also makes the total cost of electric vehicles lower than a conventional car (Ryghaug and Skjølsvold 2019). This is further supported by the development of good charging infrastructure, which contributes greatly to reduce range anxiety, a major obstacle for the adoption of electric vehicles (Ryghaug and Skjølsvold 2019).

Nevertheless, the Norwegian success is also explained by ongoing transformations in the Norwegian mobility culture (Ryghaug and Skjølsvold 2019). For some Norwegian EV drivers, the good feeling of driving nonpolluting cars outweighs the economic benefits (Ryghaug and Toftaker 2014; Ryghaug and Skjølsvold 2019). Moreover, in the context of the transition to sustainable societies and GHE reduction goals, "EV driving in Norway seems to be culturally performative of environmental- and climate-related concerns" (Ryghaug and Skjølsvold 2019, 158). However, the transition to electric mobility has not necessarily meant a reduction in car sales (Ryghaug and Skjølsvold 2019), nor less car dependency (Anfinsen 2021). On the contrary, the environmental advantages of electric cars have made some users more willing to drive in situations in which they would have walked or cycled (Anfinsen 2021). These tensions make Norway an interesting case to study whether information about the "dark side" of electric vehicle battery production affects the attitudes of a population that highly favors electric mobility.

4.2 Independent Variable

In experimental studies, the *IV* consists of the randomly assigned treatment. In this thesis, the treatment was a written text provided to the respondent right before the questions about the dependent variables. There were three treatment texts, and a short paragraph which was presented every participant to guarantee an equal starting knowledge about electric vehicles among the four groups. This general paragraph only highlighted the increase in electric vehicle adoption, which was framed as a success. This was the text:

> *"In the face of a worsening climate crisis, the surge in electric vehicles has been welcomed with optimism. While in 2016 there were only 1 million electric vehicles on the road, they are expected to reach the 20 million milestone by mid 2022 (McKerracher 2022). A remarkable step towards greener and healthier societies!"*

After the general paragraph, the three treatment groups (but not the control one) received additional information. For the first treatment group (*T1*), this consisted of a paragraph about the the social and environmental damage caused by lithium mining in Chile, followed by an explicit reflection about the unequal distribution of costs and benefits of electric mobility, and facts about the increase in lithium demand. This was the exact wording:

> *"However, electric vehicles are costly. The extraction of minerals like lithium, an important component of EV batteries, causes environmental and social problems in lithium-rich countries. A main problem is that the extraction of lithium demands an excessive amount of water. For example, 65% of the water supply of Chile's "Salar de Atacama" region is being used for lithium extraction (UN 2020). This has brought landscape damage, as well as soil and groundwater contamination, forcing local population out of their ancestral lands (UN 2020). With the rise of EVs, the demand of lithium is expected to increase by about 600% within the next 10 years (Mitchell 2021), so this situation could even worsen.*
>
> *In addition, more than 50% of the global lithium resources are concentrated in Argentina, Bolivia, and Chile (UNCTAD 2020). This results in an unfair distribution of the costs and benefits of electric mobility. That is, while some countries can enjoy the benefits from reduced pollution of EVs, others must deal with the environmental and social problems related to the production of EV batteries".*

Finally, the treatments received by the second (*T2*) and third (*T3*) treatment groups built on the additional paragraphs provided to *T1*. Besides all the information received by *T1*, *T2* and

Group	Information in text
Control	Increase in EVs as success
T1	Increase in EV as success + socio-environmental costs of lithium extraction
T2	Increase in EV as success + socio-environmental costs of lithium extraction + technological solutions
T3	Increase in EV as success + socio-environmental costs of lithium extraction + political solutions

Table 2: Information contained in each treatment text

T3 were provided with an extra paragraph which explicitly mentioned potential solutions to the problems caused by lithium extraction. Nevertheless, the paragraphs differed on the framing used to communicate the solutions. *T2*'s additional paragraph used a *technological* framing, emphasizing the role of scientists and technological development:

> *"To address this problem, dependence on these minerals must be reduced (UN 2020). Research on alternative batteries with materials such as silicon and iron will be crucial for this (Campbell 2022). Therefore, scientists and engineers need to prioritize the development of technologies based on abundant elements! (Campbell 2022)".*

In contrast, *T3*'s additional paragraph used a *political* framing, emphasizing the role of citizens and consumers:

> *"To solve this problem, dependence on these minerals must be reduced (UN 2020). Consumers and citizens can play a crucial role. They can choose alternative transportation methods like walking and cycling, and demand public policies that reduce our dependency on cars. They can also support electric vehicle regulations that would make producers pay more attention to ethical and environmental consequences".*

By using treatments that differ only on the paragraphs with additional information, the comparison between groups is more reliable and the specific treatment is easier to identify (i.e., the additional sentences). Table 2 presents a schematic description of the information included in each text[1].

[1]The full references of the articles used to write the treatment and the complete version of each treatment can be found in the Appendix A.

4.3 Dependent Variables

This thesis was interested in the effect of the *IV* on three dependent variables. The first one (*DV1*) was "positive attitudes towards electric vehicle use" and was measured in three different ways: 1) happiness with the current main means of transportation, 2) willingness to change the current means of transportation, and 3) likelihood of recommending a friend to buy an electric vehicle. In the questionnaire, respondents answered the corresponding questions using an 11 item scale, where 1 meant "extremely unhappy", "not willing at all", and "not likely at all", respectively. On the other hand, 11 meant "extremely happy", "extremely willing", and "extremely likely" depending on the question. The first two questions (i.e., happiness with the current main means of transportation, and willingness to change it) were asked before and after the treatment, so that a "difference-in-differences" design could be used to analyze the effect of information about the socio-environmental costs of electric vehicle battery production on those two measurements of *DV1*. The likelihood of recommending a friend to buy an electric vehicle was only measured after the treatment.

The second dependent variable (*DV2*), "support for policies encouraging electric vehicle adoption", accounted for a different, more collective side of attitudes towards electric vehicles. *DV2* was also measured in three ways: 1) likelihood of voting for a party that stands for policies which make electric vehicles cheaper to buy, 2) likelihood of voting for a party that stands for policies that require electric vehicle producers to give information about the origin of their supplies, and 3) likelihood of voting for a party that stands for subsidizing the price of public transportation tickets instead of incentives that make electric vehicles cheaper to buy. In the three cases, the likelihood of voting for the hypothetical party was measured on an 11 item scale, in which 1 meant "not likely at all", and 11 meant "extremely likely". The number provided by the respondent was taken as an indicator of their support for the described policy.

Finally, the third dependent variable (*DV3*) was "willingness to be politically engaged". *DV3* was measured in four ways: 1) willingness to learn more about how and where electric vehicles are produced, 2) willingness to participate in a protest against the destruction of natural ecosystems around the world, 3) willingness to donate money to an organization working against the destruction of natural ecosystems around the world, and 4) willingness to volunteer for an organization working against the destruction of natural ecosystems around the world. Similar to the measurements for *DV1* and *DV2*, the willingness to participate in these political activities were also measured on an 11 item scale, where 1 meant "not willing at all", and 11 meant "extremely willing". This way of measuring the intention of being politically engaged was based on Lu's (2021) measurements of collective action intentions in her experimental study about the role of emotions in motivating collective action for environmental justice.

4.4 Control Variables

The control variables were, mainly, standard socio-demographic characteristics like age, gender, educational level, socio-economic class, city, and the area where the respondent lives (i.e., big city, suburbs, small city, etc.). The socio-demographic questions used in the questionnaire were taken directly from the 20th round of the Norwegian Citizen Panel (2022). Additionally, some control variables related to political orientation and engagement were included. Among them, the questions about left-right positioning on a political scale, as well as the question about the political party of preference were also taken directly from the 20th round of the Norwegian Citizen Panel (2022).

Given the topic of the study, control variables related to main means of transportation were also included. Among them, questions about electric vehicle use, desire for an electric vehicle, and the motivations for (not) driving or wanting to drive an electric vehicle. This last control variable was motivated by Liu et.al.'s (2022) research, which has shown that the motivations for owning an electric vehicle are relevant for understanding the effect of information on attitudes towards electric vehicles. Finally, environmental, justice, and cosmopolitan attitudes were also included as control variables, as they have been shown relevant for understanding phenomena such as ethical consumption (Lee, Jin, and Shin 2018), and pro-environmental behavior[2].

4.5 Data Collection Process

The data collection was done through an online questionnaire built with *Qualtrics*. This tool was also useful for randomizing the treatments, and for protecting the respondents' privacy by

[2]The exact questions used for the control variables are available in the appendix.

making the survey completely anonymous. The target population were people living or working in Norway, regardless of the nationality. The questionnaire contained a total of 40 questions (excluding the treatment), and was expected to take approximately ten minutes to answer. The questions and the treatments were originally written in English. However, both were translated by a native speaker, and published in Norwegian to reduce the risk of misunderstandings by the respondents.

One of the main challenges was incentivizing the participation in the study. Two approaches were taken to overcome this problem. First, those who completed the survey were offered the chance to participate in a lottery to win a single prize of a 1000 Norwegian kroner (approximately 100 euro) gift card to be used in movie theaters across the country. Those who were willing to participate had to voluntarily provide their email address at the end of the survey. Second, the lottery incentive was complemented with a kind request for help with the thesis. The message had a personal tone instead of an academic one and emphasized information about my country of origin, my university, and my desire to learn about electric vehicles in Norway. It is hard to measure exactly how many people were motivated by the message alone. However, there is reason to believe that the non-monetary incentive was useful, as there were several respondents who did not wish to participate in the lottery.

The survey was distributed through two main channels. One of them was paid advertisement on Facebook. The ad was written entirely in Norwegian and was posted on a Facebook page created solely for the purpose of this study. After a brief review process, the post was aproved and kept in circulation for four days (from May, 26th to May, 30th). Given that Facebook's paid advertisement functions allow specifying the target demographic, the ad was set to be shown to men and women who were 18 years old or older. Additionally, it was programmed to increase the exposure of the Facebook post among people living in a 30 kilometer radius from the cities of Oslo, Bergen, Trondheim, Stavanger, and Kristiansand, all of them major Norwegian cities. Regarding the geographic specifications on Facebook, a limitation is that Apple's iOS-14 and European data privacy controls allow users to disable tracking. Additionally, the audience that Facebook reaches is biased towards older women. According to the report provided by Facebook, 62.1% of the 11,332 persons reached by the ad were women. Moreover, people

55 years and older constituted 46.7% of the reached public. On the contrary, people between 18 and 34 were represented only 21.6%.

The second channel used to circulate the survey was Reddit, a popular internet forum with subpages (called "subreddits"). A post in English with the link to the survey, information about the gift card lottery, and a kind request for help was posted in the *r/oslo* subreddit two days after starting the Facebook ad. Ideally, the survey would have been posted on country-wide subreddits. However, the community guidelines prohibited research surveys. Despite not being paid, the post had a reach of 7,300, according to the numbers provided by Reddit. However, a limitation of this platform is that young, educated males are over represented. Additionally, it is necessary to consider that people that do not live in Norway have access to the survey (which might also happen on Facebook). This is because the *r/oslo* subreddit is open to everyone interested in the city, regardless from where they live. Most likely, the fact that the survey was entirely in Norwegian and that the lottery prize is to be used only within Norway reduces the chances of people not living or working in Norway answering the survey.

Finally, another challenge of using Facebook and Reddit is that users tend to comment on the posts. In the case of Facebook, most of the comments were friendly, however some of them questioned the legitimacy of the study. These reactions could have had a negative impact on people's willingness to answer the survey. In a different way, comments on Reddit were also a source of concern, as users started commenting the question about main means of transport. After the first comments, the post was edited to include an explicit request for users not to discuss the survey, as it could bias potential respondents. Fortunately, Reddit users did not provide information that could affect the study (e.g., revealing the treatment) and limited their comments to pointing out the limitations of the question about main means of transportation. Therefore, when conducting experiments through an online survey, it is important to keep in mind that maintaining the conditions that guarantee a controlled environment becomes considerably harder.

5 Descriptive Statistics

The data collection process was finished with a total of 256 completed responses. However, the lower 10th percentile based on survey completion time was removed to exclude the respondents who took an unreasonably low time to complete the survey, as it is likely that they did not took their participation seriously. The resulting dataset contained a total of 229 observations.

From the total sample, 39.3% of the respondents were women,59.83% were men , and 0.87% preferred not to answer. These percentages show that men are over represented in the sample, which is likely to be explained by the use of Reddit as a diffusion channel. In terms of geographic distribution, there is an over representation of the Norwegian capital, as 59.39% of the respondents indicated living Oslo. The second most frequent city was Bergen, representing 10.92% of the sample. Respondents from Trondheim, Stavanger, and Kristiansand represented 7.42%, 4.8% , and 3.93%, respectively. There was also a significant amount of respondents who indicated living in a city other than listed ones, representing 13.1% of the sample.

Another relevant detail is that most of the respondents described the are where they live in as a big city. This represented 54.15%, while those living in the suburbs or outskirts of a big city constituted 27.51%. As the third most frequent answer, 13.97% of the respondents indicated living in a small or a medium sized city. These percentages suggest that people living in more rural parts of Norway are underrepresented in the sample. This is most likely due to the distribution on social media, which targeted major Norwegian cities and areas close to them.

In terms of educational level, the sample was highly educated, as 69.87% of the respondents indicated having university or college ("høyskole" in Norwegian) as their highest completed education. The data provided by the Norwegian Citizen Panel also suggests that the Norwegian population is highly educated, having 64.3% of their respondents indicate that they have college or university education (2022). Another characteristic in which the sample is similar to the population is the distribution of socio-economic class. In the national census, the middle class was the most represented one (59.3%), followed by the upper middle class (19%), and the working class (12%) (Ivarsflaten et al. 2022). As Figure 1 shows, those were also the three most represented social classes in the sample.

Information about the respondents' means of transportation is also relevant. When asked

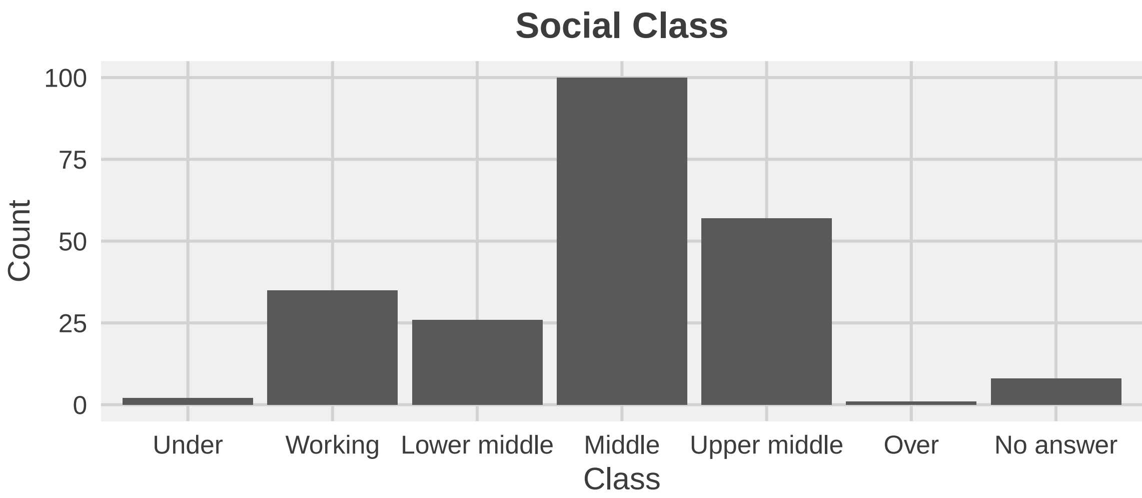

Figure 1: Respondents' self-reported socio-economic class

to select the means of transportation they usually use outside work, 34.93% of the participants indicated using public transportation. Electric vehicles (including hybrid cars) and conventional fossil fuel cars were the second and the third most common responses, representing 30.57% and 15.28% of the sample, respectively. Surprisingly, when those who did not usually drive an electric vehicle where asked whether they wanted to get one in the near future, the responses were almost evenly split between "Maybe" ($n = 58$), "Yes" ($n = 53$), and "No" ($n = 47$).

Among those who currently drive or would like to drive an electric vehicle, 44.2% indicated that their motivation was mainly an economic one. Environmental motivations were the second most frequent ones, representing 37.57% of the answers to this question. The strong presence of economic motivations for using or wanting to use an electric vehicle is not surprising, given that economic incentives have been central in the Norwegian strategy for encouraging electric vehicle adoption. The main motivations of those who do not drive an electric vehicle and would not like to drive one are slightly different. The main motivation among these respondents was a practical one, representing 42.55% of the answers to the question about. However, economic motivations were also relevant, albeit as the second most frequent answer. They represented 25.53% of the answers to the question.

In terms of political orientation, the sample shows different preferences compared to the Norwegian population. As Figure 2 illustrates, there is a considerable difference between the sample's preference for left leaning parties (e.g., R, and SV) and the green party (MDG), and the results of the Norwegian parliamentary elections in 2021 (Valgdirektoratet 2021).

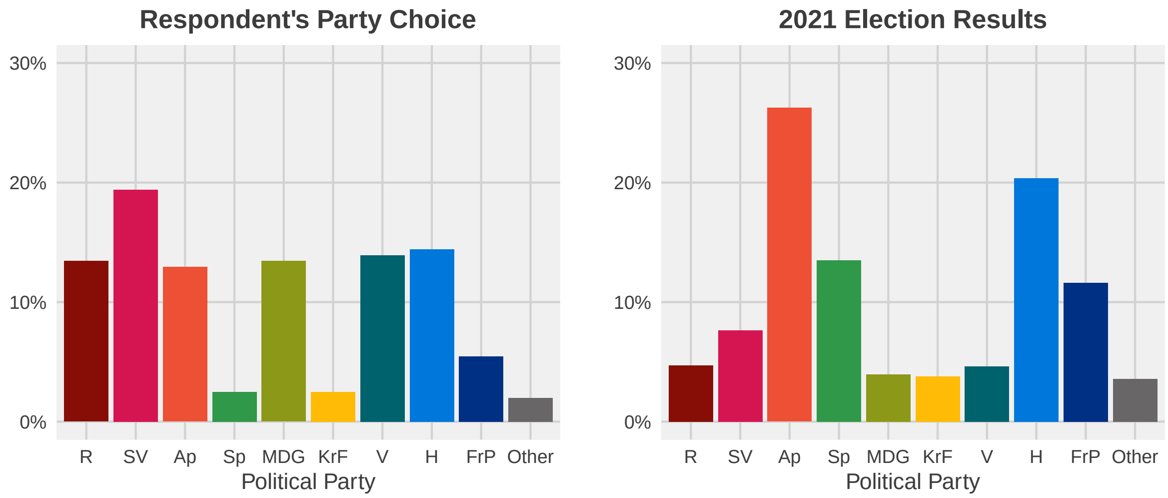

Figure 2: Comparison of respondent's party preference (left) and 2021 national parliamentary elections (right)

Finally, Table 3 provides the summary statistics for all the numeric variables. About the control variables, it is worth noting that there is a wide age range among the respondents, which is also likely to be explained by the online platforms used to distribute the survey. Moreover, it is interesting to see that the mean value for both justice attitude measurements (`ctr_just1` and `ctr_just2`) are relatively high. Additionally, all the dependent variables and their respective measurements have also been included in the table. All of them have a variable name starting with `dv_`. In all of them, the responses range from the minimum to the maximum value of the 11 item scale used to measure the variables. Nevertheless, it is possible to say that the standard deviation is not particularly high in any of them.

5.1 Group Balance Check

The strength of experimental designs relies on the advantages that randomization provides. Therefore, it is important to assess whether the groups were properly randomized in the sample used for this study. First, regarding the size of the groups, the *Qualtrics* randomization tool was helpful to get similarly sized groups: the control group had 57 participants, *T1* had 58, *T2* had 56, and *T3* had 58. Additionally, it is possible to say that all the four groups have similar pre-treatment characteristics. Although the proportions vary slightly, for most of the variables,

Table 3: Summary statistics of numeric variables

Statistic	N	Mean	St. Dev.	Min	Max
age	229	41.686	16.707	14	85
left_right	219	4.854	2.539	1	11
ctr_protest	228	3.868	2.625	1	11
ctr_volunt	228	4.741	2.604	1	11
ctr_env2	228	6.618	1.921	1	11
ctr_just1	224	8.710	2.343	1	11
ctr_just2	223	7.735	2.462	1	11
ctr_cosm1	229	8.074	2.127	1	11
ctr_cosm2	228	6.171	2.858	1	11
pre_satisf	227	8.577	2.094	1	11
pre_change	228	5.118	2.799	1	11
dv1_post_satisf	225	8.507	2.070	1	11
dv1_post_change	225	5.178	2.828	1	11
dv1_friend	226	8.159	2.657	1	11
dv2_sales	221	6.697	2.775	1	11
dv2_reg	215	7.428	2.456	1	11
dv2_ptransp	222	7.986	2.761	1	11
dv3_learn	223	7.475	2.473	1	11
dv3_protest	222	4.180	2.805	1	11
dv3_donate	221	5.611	2.999	1	11
dv3_volunt	221	4.421	2.676	1	11
diff_satisf	224	−0.076	1.019	−9	3
diff_change	225	0.093	1.499	−5	10

the most represented category is the same for all the groups.

For example, Table 4 shows that the groups do not diverge significantly regarding the number of male and female participants, despite the former being more in all the groups. Similarly, when age is taken into account, it is possible to see that in all the groups, the median age of women is higher than the median age of men, which is likely to be explained by Facebook being popular with older women and Reddit with younger men. This can be seen in Figure 3.

Table 4: Count of males and females per group

	Control (n=58)	T1 (n=58)	T2 (n=58)	T3 (n=58)
Males	32	39	31	35
Females	25	19	24	22
No answer	0	0	1	1

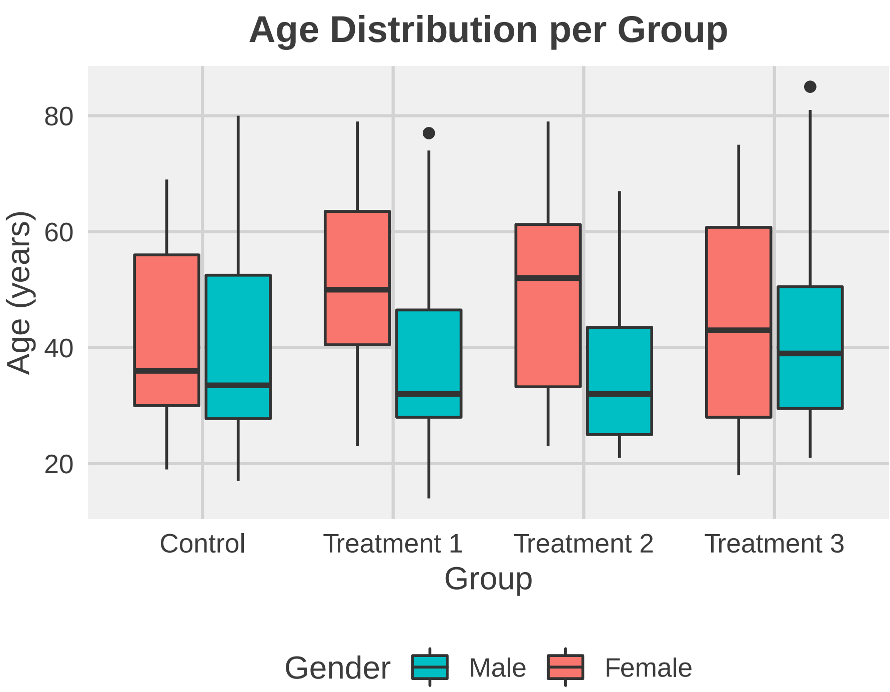

Figure 3: Age distribution by gender per group

Regarding the city and area where the respondents live, the groups are also fairly balanced. Similar to the total sample, Oslo is over represented in all the groups. Furthermore, in all the groups, most respondents indicated living in a big city, while the second and third most common answers were "suburbs or the outskirts of a big city", and "small or medium sized city" respectively. Table 5 shows the city count per group, while Table6 shows the same for the area.

Table 5: Count of cities per group

	Control (n=58)	T1 (n=58)	T2 (n=58)	T3 (n=58)
Other	4	10	5	11
Bergen	7	7	8	3
No answer	1	0	0	0
Kristiansand	3	1	3	2
Oslo	33	34	33	36
Stavanger	3	4	1	3
Trondheim	6	2	6	3

Table 6: Count of area per group

	Control (n=58)	T1 (n=58)	T2 (n=58)	T3 (n=58)
Suburbs or outskirts of a big city	19	14	14	16
Small or medium sized city	7	10	7	8
Big city	31	32	32	29
Village center	0	1	1	2
Sparsely populated area	0	1	0	3
No answer	0	0	2	0

In terms of the main means of transportation, the groups show slightly more variation, albeit not enough to be regarded as unbalanced. As Table6 shows, electric cars and public transportation are the most common categories. Nevertheless, the former is the most frequent in *T1* and *T3*, while the latter is the most frequent for the control group and *T2*. The small differences between the groups are not problematic for the analysis, especially given that this variable is controlled for in the model.

Table 7: Count of main means of transportation per group

	Control (n=58)	T1 (n=58)	T2 (n=58)	T3 (n=58)
Other electric vehicles (e.g., e-scooter	3	5	3	5
Other	5	0	1	0
Electric car (including hybrids)	18	20	14	18
Fossil car	5	11	8	11
Public Transportation	24	18	21	17
Bicycle	2	4	9	7

Finally, attitudinal control variables are also relevant, as they might influence the effect. Given that each these attitudes was measured with several different questions, both the figure and the models include only one for each. As Figure 4 shows, the groups are fairly balanced in terms of environmental (`ctr_env2`) and justice attitudes (`ctr_just2`). However, there is more variation regarding cosmopolitan attitudes, both between and within the groups. Again, this is not an issue for the analysis, because attitudinal variables have been included in the models as control variables.

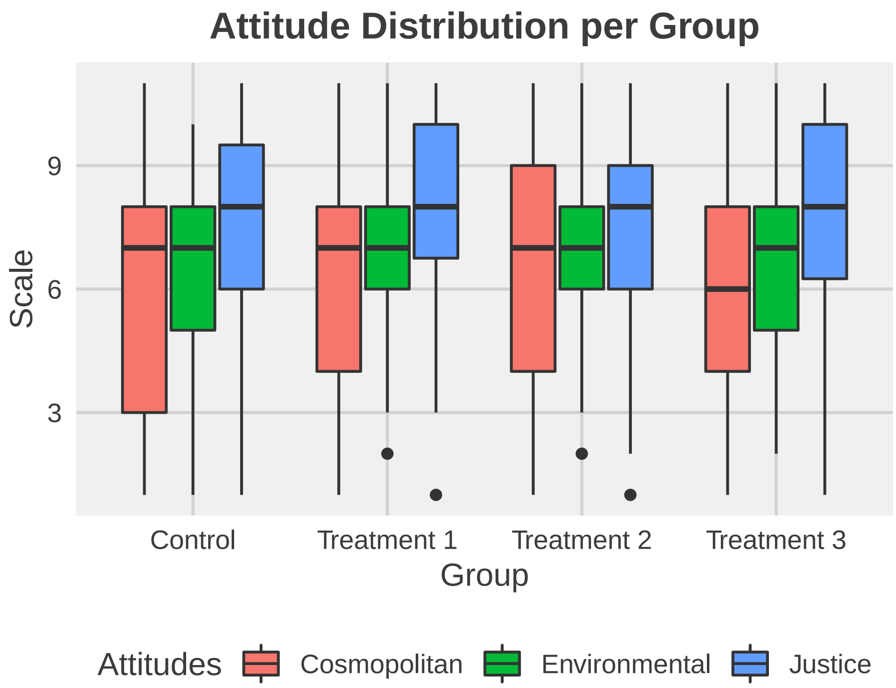

Figure 4: Comopolitan, environmental, and justice attitudes per group

5.2 Manipulation Check

The survey included manipulation checks to make sure that the respondents had read the assigned text and, more importantly, understood the nuances of the information provided. However, given the variation in the amounts of information that each treatment communicated, not all the respondents answered the same manipulation checks. The treatment groups received three questions about details provided by the text. The first two (`man2_countries`, and `man3_water`) checked if the respondents had read the text attentively. The third one (`man4_role`) was intended to assess whether the respondents understood the framing of the solution (or the lack of them).

Three other questions were asked to all the participants, including the control group. The first one (`man1_new`) was excluded from the manipulation check because it did not provide useful additional information. The other two were asked by the end of the survey to avoid priming the control group. Using a scale from 1 to 11, respondents were asked to rate electric vehicles in terms of sustainability (man5_sust), and ethics (man6_ethics). If the manipulation was successful, it was expected that the treatment groups would have a lower mean rating for both characteristics in comparison to the control group.

For an easier calculation, the questions with a correct answer (man2_countries,man3_water, and man4_role) have been re-coded as binary variable, where 1 means correct, and 0 means incorrect. As the two first columns of Table 8 show, most respondents remembered details provided by the texts. However, the third column suggest that about half of the respondents in each group understood the framing used for communicating the solutions. Moreover, the last two columns show a very small difference between the average rating given by each group. Therefore, it is reasonable to conclude that the manipulation was weak or only partially successful, which needs to be accounted for when interpreting the results.

Table 8: Mean values of manipulation checks per group

	man2_countries	man3_water	man4_role	man5_sust	man6_ethic
control				6.30	6.42
treat1	0.90	0.84	0.50	6.36	6.04
treat2	0.82	0.75	0.57	6.19	5.72
treat3	0.86	0.69	0.59	6.18	5.93

6 Analysis

To test the main hypothesis, as well as the additional ones, twelve multiple linear regression models were used. Following the academic standard, to reject a null hypothesis, a significance level of 0.05 was required. The regression tables presented in this section only include the most relevant coefficients. However, complete results for each model can be found in the Appendix B.

6.1 DV 1: Positive Attitudes Towards Electric Vehicle Use

For the first and second measurement of *DV1* (i.e., positive attitudes towards electric vehicle use), a difference in differences design was used. As explained in the corresponding section, the questions required the respondents to rate their satisfaction with their current main means of transportation, as well as their willingness to change it. These same questions were asked before and after the treatment, therefore, the change in the rating was calculated by subtracting the pre-treatment answer to the post-treatment answer. The first (`dv1_1ev`) and the second (`dv1_1no_ev`) multiple linear regression models use the change in satisfaction with the main means of transportation (`diff_satisf`) as dependent variable, while the third (`dv1_2ev`) and the fourth (`dv1_2no_ev`) use the change in willingness to change the current means of transportation (`diff_change`). Given that the questions are dependent on the respondent's main means of transportation, the first model (`dv1_1ev`) and third model (`dv1_2ev`) include only the observations of participants who drive an electric vehicle as main means of transportation. In contrast, the second (`dv1_1no_ev`) and fourth model (`dv1_2no_ev`) includes only those observations of participants who do not drive an electric vehicle as main means of transportation.

6.1.1 Measurement 1

The first model (`dv1_1ev`) included age, educational level, social class, city, area, political orientation (`left_right`), environmental attitudes (`ctr_env2`), justice attitudes (`ctr_just2`[3]), cosmopolitan attitudes (`ctr_cosm2`), and motivation to drive an electric vehicle as main means of transportation. In comparison to the control group, *T1* (`group1`) shows a negative change in terms of satisfaction with the main mains of transportation (-0.215), which means that *T1* decreased their satisfaction with their main means of transportation after the treatment. Although the effect occurred in the expected direction, the coefficient is not statistically significant (*p*-value $= 0.5124$). Therefore, it is not possible to reject the following null sub-hypothesis: *"for EV users, information about the socio-environmental costs of EV battery has no effect on their satisfaction with their main means of transportation"*.

The second model (`dv1_1no_ev`) included the all the control variables used in the first model, but added willingness to get an electric vehicle (`will_ev`), and the motivation of non electric vehicle drivers for keeping their current main means of transportation (`motiv_not_change`). In this model, *T1* also showed a negative change regarding their

[3]This measurement of justice attitudes was chosen over the alternative measure because this one accounted for the participant's response given an unfair distribution of costs (as workload), rather than an unfair distribution of benefits (as salary bonus). Therefore, it was more appropriate to control for the attitudes towards the unfair distribution of socio-environmental costs highlighted on the treatments.

satisfaction with their current means of transportation. This means that, regardless of their main means of transportation, *T1* decreased their satisfaction with their current means of transportation, which is contrary to the expectation that the direction of the change would differ depending on that. Despite the results, the coefficient for *T1* (`group1`) is also not statistically significant for the second model (p-value $= 0.8750$). Therefore, it is not possible to reject the following null sub-hypothesis: *"for users with a main means of transportation other than an EV, information about the socio-environmental costs of EV battery has no effect on their satisfaction with their main means of transportation"*. Table 9 presents the relevant results for the first and second model.

Table 9: Regression Table for First and Second Models

	Dependent variable:	
	diff_satisf	
	1st Model (dv1 1ev)	2nd Model (dv1 1no ev)
T1	−0.215	−0.046
	(0.326)	(0.289)
T2	0.049	−0.200
	(0.382)	(0.285)
T3	0.284	−0.008
	(0.349)	(0.296)
Control	0.089	−0.088
	(1.181)	(0.853)
Observations	68	141
R^2	0.353	0.382
Adjusted R^2	−0.057	0.160
Residual Std. Error	0.819 (df = 41)	1.016 (df = 103)
F Statistic	0.862 (df = 26; 41)	1.722** (df = 37; 103)
Note:		*p<0.1; **p<0.05; ***p<0.01

6.1.2 Measurement 2

The third (`dv1_2ev`) model differed with the first one (`dv1_1ev`) only in terms of the dependent variable, as all the same control variables were included[4]. As expected and in opposition to the control group, *T1* slightly increased their willingness to change their current means of transportation after the treatment. However, considering the 0.05 significance level threshold, *T1*'s change in willingness to change their main means of transportation is not statistically significant (p-value $= 0.0916$)[5]. Therefore, it is not possible to reject the following null sub-hypothesis: *"for EV users, information about the socio-environmental costs of EV battery has no effect on their willingness to changer their main means of transportation"*.

The fourth model (`dv1_2no_ev`) also differed with the second one (`dv1_1no_ev`) only in terms of the dependent variable[6]. In comparison to the control group, *T1* presented a lower decrease on their willingness to change their main means of transportation after receiving the treatment (*coef* $= 0.807$). In this model, the coefficient for *T1* is statistically significant (p-value $= 0.0460$). Therefore, it is possible to reject the following null sub-hypothesis: *"for users with a main means of transportation other than an EV, information about the socio-environmental costs of EV battery has no effect on their willingness to change their main means of transportation"*. Table 10 presents the relevant results for the third and fourth model.

6.1.3 Measurement 3

In contrast to the previous four models, the fifth model (`dv1_3`) used the likelihood of recommending a friend to buy an electric vehicle (`dv1_friend`) as a dependent variable, which did not measure a change between attitudes before and after the treatment. Given that the sub-hypothesis did not made differences depending on the main means of transportation, all the observations of the dataset were used to run the model. The control variables included were age, educa-

[4]The control variables for the first model were age, educational level, social class, city, area, political orientation, environmental attitudes, justice attitudes, cosmopolitan attitudes, and motivation to drive an electric vehicle as main means of transportation.

[5]It is worth noting, however, that with a higher significance threshold (e.g. 0.1), it would be possible to reject this null sub-hypothesis

[6]The control variables for the first model were age, educational level, social class, city, area, political orientation, environmental attitudes, justice attitudes, cosmopolitan attitudes, motivation for wanting to drive an electric vehicle as main means of transportation, willingness to get an electric vehicle, and the motivation of non electric vehicle drivers for keeping their current main means of transportation.

Table 10: Regression Table for Third and Fourth Models

	Dependent variable:	
	diff_change	
	3rd Model (dv1 2ev)	4th Model (dv1 2no ev)
T1	0.879*	0.807**
	(0.509)	(0.400)
T2	1.013*	0.286
	(0.596)	(0.396)
T3	0.408	0.523
	(0.544)	(0.413)
Control	−0.358	−2.269*
	(1.843)	(1.207)
Observations	68	142
R^2	0.411	0.328
Adjusted R^2	0.037	0.089
Residual Std. Error	1.278 (df = 41)	1.444 (df = 104)
F Statistic	1.100 (df = 26; 41)	1.374 (df = 37; 104)
Note:		*p<0.1; **p<0.05; ***p<0.01

tional level, social class, city, area, political orientation (`left_right`), environmental attitudes (`ctr_env2`), justice attitudes (`ctr_just2`), and cosmopolitan attitudes (`ctr_cosm2`). Additionally, motivation to drive an electric vehicle as main means of transportation (`motiv_ev`), willingness to get an electric vehicle (`will_ev`), and the motivation of non electric vehicle drivers for keeping their current main means of transportation (`motiv_not_change`) were also included, given that the sample included all the observations, regardless of their main means of transportation.

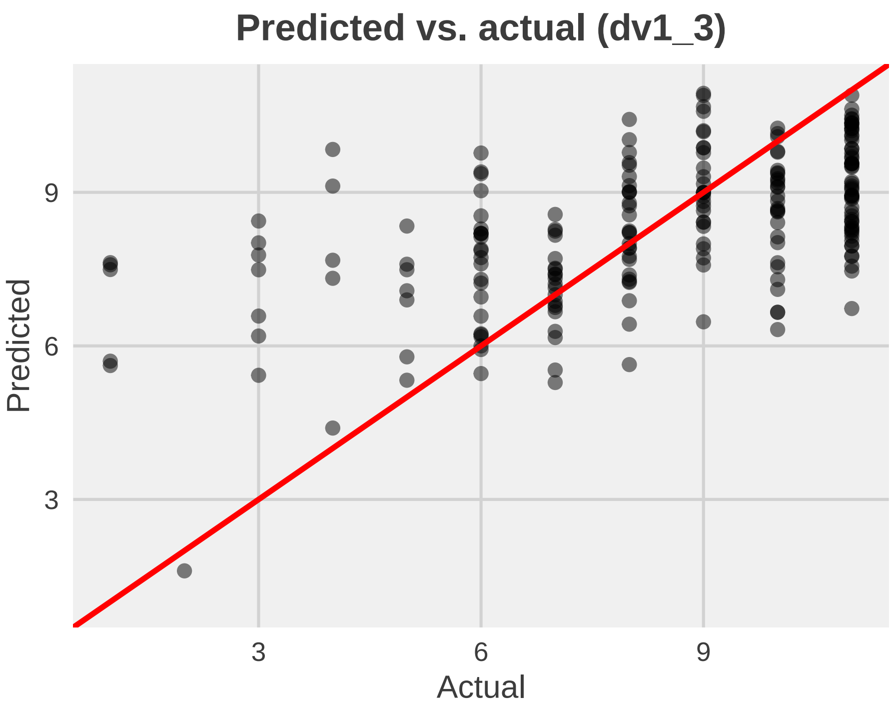

Figure 5: Comparison of predicted and real values for dv1 friend

As expected, *T1* shows a decrease in likelihood of recommending a friend to buy an electric vehicle (*coef* $= -0.504$). Nevertheless, the coefficient was not statistically significant (p-value $= 0.31677$), which prevents us from rejecting the following null sub-hypothesis: *"information about the socio-environmental costs of electric vehicle battery production has no effect on likelihood of recommending a friend to buy an electric vehicle"*. Table 11 presents the relevant results for the fifth model, while Figure 5 shows the comparison between real and predicted values for `dv1_friend`.

In conclusion, for *DV1* (i.e., attitudes towards electric vehicle use), only one null sub-

Table 11: Regression Table for Fifth Model

	Dependent variable:
	dv1_friend 5th Model (dv1 3)
T1	−0.504
	(0.502)
T2	−0.420
	(0.503)
T3	−0.401
	(0.521)
Control	10.106***
	(3.119)
Observations	211
R^2	0.316
Adjusted R^2	0.140
Residual Std. Error	2.351 (df = 167)
F Statistic	1.792*** (df = 43; 167)
Note:	*p<0.1; **p<0.05; ***p<0.01

hypothesis could be rejected[7] considering a significance level threshold of 0.05. More specifically, it was only possible to reject half of a null sub-hypothesis, as the statistically significant coefficient was found for the respondents with a main means of transportation other than an electric vehicle, but not for those who have an electric vehicle as a main means of transportation. Therefore, there is no support for rejecting *H1-null* (i.e., *"Information about the socio-environmental costs of electric vehicle battery production has no effect on positive attitudes towards electric vehicle use"*.)

6.2 DV 2: Support Towards Policies That Encourage Electric Vehicle Adoption

The sixth (`dv2_1`), seventh (`dv2_2`), and eighth (`dv2_3`) models were used for *DV2* (i.e., attitudes towards electric vehicle policies that encourage EV adoption). The three of them included the same control variables. These were age, educational level, social class, city, area, political orientation (`left_right`), environmental attitudes (`ctr_env2`), justice attitudes (`ctr_just2`), and cosmopolitan attitudes (`ctr_cosm2`), motivation to drive an electric vehicle as main means of transportation (`motiv_ev`), willingness to get an electric vehicle (`will_ev`), and the motivation of non electric vehicle drivers for keeping their current main means of transportation (`motiv_not_change`). These models also included "interest in politics" (`int_pol`) as an additional control variable. It was included because *DV2* was measured as likelihood of voting for a party standing for a given policy, and those with low interest in politics could be less willing to vote, regardless of the policy proposed. Table 12 presents the relevant results for the sixth, seventh, and eighth models.

6.2.1 Measurement 1

The sixth model (`dv2_1`) used the likelihood of voting for a party that stands for policies which make electric vehicle cheaper to buy as dependent variable (`dv2_sales`). As expected, *T1* shows a decrease in likelihood of voting for a party that stands for policies which make electric vehicles

[7] *"for users with a main means of transportation other than an EV, information about the socio-environmental costs of EV battery has no effect on their willingness to change their main means of transportation"*

cheaper to buy (*coef* $= -0.231$). However, the coefficient is not statistically significant (*p*-value $= 0.66809$). Therefore, it is not possible to reject the following null sub-hypothesis: *"information about the socio-environmental costs of electric vehicle battery production has no effect on the likelihood of voting for a party that stands for policies which make electric vehicles cheaper to buy"*.

6.2.2 Measurement 2

The seventh model (`dv2_2`) used the likelihood of voting for a party that stands for policies which require electric vehicle producers to be more transparent with the source of their materials as dependent variable (`dv2_reg`). As expected, *T1* (`group1`) shows an increase in likelihood of voting for a party that stands for policies which require electric vehicle producers to be more transparent with the source of their materials (*coef* $= 0.850$). However, the coefficient is not statistically significant in this case either (*p*-value $= 0.06577$). Therefore, it is not possible to reject the following null sub-hypothesis: *"information about the socio-environmental costs of electric vehicle battery production has no effect on the likelihood of voting for a party that stands for policies which require electric vehicle producers to be more transparent about the source of their materials"*.

6.2.3 Measurement 3

The eighth model (`dv2_3`) used the likelihood of voting for a party that stands for subsidizing public transportation to make it more affordable instead of supporting incentives for electric vehicles to be cheaper to buy (`dv2_ptransp`). Opposite to what was expected, *T1* showed a decrease in likelihood of voting for a party that supports such a policy in comparison to the control group (*coef* $= 0.850$). This is an interesting result not only because it is the only one for *DV2* which goes against the expectations, but also because it was the only measurement which explicitly included a trade-off. Nevertheless, in this case again, the coefficient for *T1* is not statistically significant (*p*-value $= 0.6695$). Therefore, it is not possible to reject the following null sub-hypothesis: *"information about the socio-environmental costs of electric vehicle battery production has no effect on the likelihood of voting for a party that stands for* *subsidizing public transportation to make it more affordable instead of supporting incentives for electric vehicles to be cheaper to buy"*. Figure 6 presents the comparison of predicted and real values for the likelihood of voting for a party that stands for subsidizing public transportation to make it more affordable instead of supporting incentives for electric vehicles to be cheaper to buy.

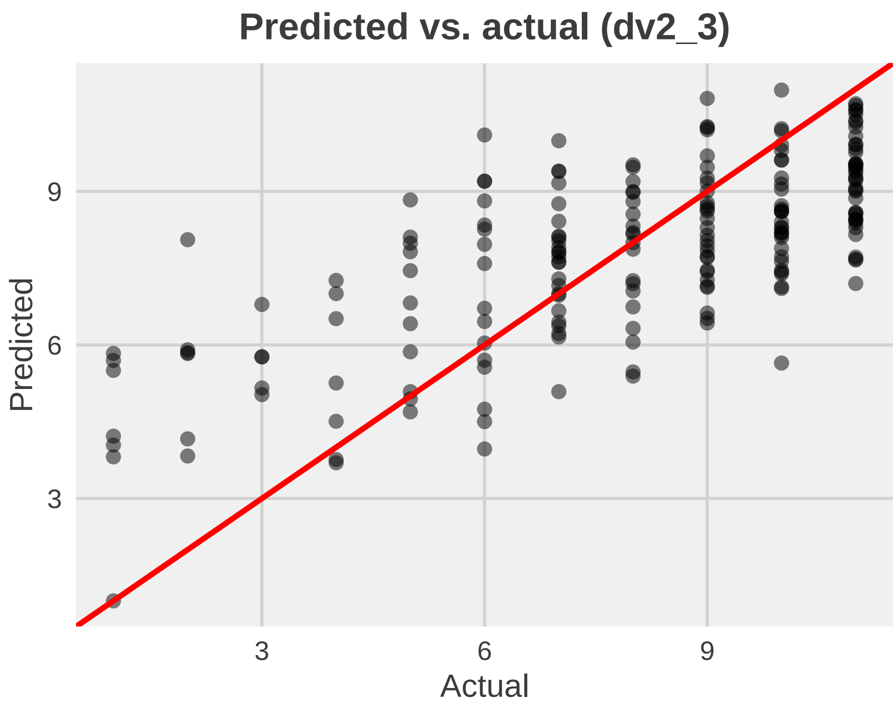

Figure 6: Comparison of predicted and real values for dv2 ptransp

In conclusion, for *DV2* (i.e., attitudes towards electric vehicle policies that encourage EV adoption), no sub-hypothesis can be rejected with a significance level threshold of 0.05. Therefore, there is no support for rejecting *H2-null* (i.e., *"information about the socio-environmental costs of electric vehicle battery production has no effect on positive attitudes towards electric vehicle policies aimed at encouraging electric vehicle adoption"*).

6.3 DV 3: Willingness to Be Politically Engaged

The ninth (`dv3_1`), tenth (`dv3_2`), eleventh (`dv3_3`), and twelfth (`dv3_4`) models were used for *DV3* (i.e., willingness to be politically engaged). All the four models included age, educational level, social class, city, area, political orientation (`left_right`), environmental attitudes

Table 12: Regression Table for Sixth, Seventh, and Eighth Models

	Dependent variable:		
	dv2_sales 6th Model (dv2 1)	dv2_reg 7th Model (dv2 2)	dv2_ptransp 8th Model (dv2 3)
T1	−0.231	0.850^{*}	−0.206
	(0.539)	(0.459)	(0.481)
T2	0.591	0.015	−0.270
	(0.546)	(0.465)	(0.488)
T3	−0.585	0.731	−0.282
	(0.564)	(0.488)	(0.508)
Control	3.023	3.336	6.506^{**}
	(3.153)	(2.650)	(2.600)
Observations	209	205	209
R^2	0.324	0.393	0.482
Adjusted R^2	0.127	0.216	0.331
Residual Std. Error	2.500 (df = 161)	2.120 (df = 158)	2.239 (df = 161)
F Statistic	1.645^{**} (df = 47; 161)	2.220^{***} (df = 46; 158)	3.188^{***} (df = 47; 161)

Note: *p<0.1; **p<0.05; ***p<0.01

(ctr_env2), justice attitudes (ctr_just2), and cosmopolitan attitudes (ctr_cosm2), motivation to drive an electric vehicle as main means of transportation (motiv_ev), willingness to get an electric vehicle (will_ev), and the motivation of non electric vehicle drivers for keeping their current main means of transportation (motiv_not_change) as control variables. Additionally, the tenth (dv3_2) model controlled for likelihood of participating on a protest about a cause important for the respondent (ctr_protest). Similarly, the eleventh (dv3_3) model included an additional control variable for the likelihood of doing volunteer work (ctr_volunt). These additional control variables were included because the measurements for *DV3* used in the tenth (dv3_2) and eleventh (dv3_3) models refer to the willingness of participating in a protest and doing voluntary work, respectively.

6.3.1 Measurement 1

The ninth model (dv3_1) used willingness of learning more about how and where electric vehicles are produced as dependent variable. As expected, *T1* shows an increase in willingness to learn more about how and where electric vehicles are produced ($coef = 0.275$). However, the coefficient is not statistically significant (*p*-value=0.573759). Therefore, it is not possible to reject the following null sub-hypothesis: *"information about the socio-environmental costs of electric vehicle battery production has no effect on the willingness to learn more about how and where electric vehicles are produced"*. Figure 7 presents the comparison between predicted and real values for willingness of learning more about how and where electric vehicles.

Nevertheless, despite not being able to reject the null sub-hypothesis about the treatment effect, it is interesting to note that the coefficient for justice attitudes (ctr_just2) is statistically significant (*p*-value $= 0.000471$). The coefficient indicates that there is an increase of 0.270 in willingness to learn more about how and where electric vehicles are produced, for each additional unit of the second measurement used for justice attitudes.

6.3.2 Measurement 2

The tenth (dv3_2) model used willingness to participate in a protest against the destruction of natural ecosystems around the world (dv3_protest) as dependent variable. The coefficient for

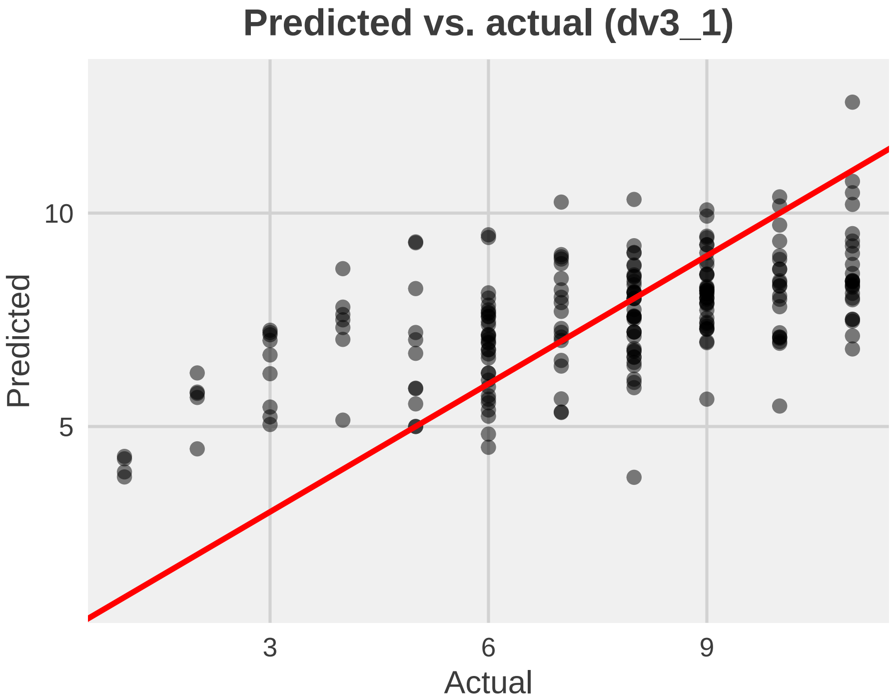

Figure 7: Comparison of predicted and real values for dv3 learn

T1 (-0.256) indicated a small decrease in willingness to participate in such a protest. However, the resulting p-value (0.519949) did not allow the rejection of the following null sub-hypothesis: *"information about the socio-environmental costs of electric vehicle battery production has no effect on willingness to participate in a protest against the destruction of natural ecosystems around the world"*.

It is worth noting, nevertheless, that control variables related to environmental concerns and protest behavior showed statistically significant coefficients. This was the case for likelihood of participating in a protest about a cause that mattered to the respondent (*coef* $= 0.473$, p-value $= 1.21e-12$), cosmopolitan attitudes (*coef* $= 0.148$, p-value $= 0.009119$), environmental attitudes[8] (*coef* $= 0.218$, p-value $= 0.004585$), and having mainly environmental motivations to drive or wanting to drive an electric vehicle (*coef* $= 2.004$, p-value $= 0.000377$). It is interesting as well, that all of these coefficients indicate an increase in willingness to participate in such a protest.

[8]The measurement of environmental attitudes (`ctr_env2`) used in this model asked the respondents to rate their lifestyles in terms of sustainability on a scale from 1 to 11, where 1 meant "not sustainable at all" and 11 meant "extremely sustainable".

6.3.3 Measurement 3

The eleventh (`dv3_3`) model used willingness to donate to an organization working against the destruction of natural ecosystems around the world (`dv3_donate`) as dependent variable. Like in the previous case, the coefficient for *T1* (-0.141) indicates a small decrease in willingness to donate money to such an organization. However, this coefficient was also not statistically significant (p-value $= 0.8006$). Therefore, it was not possible to reject the following null sub-hypothesis: *"information about the socio-environmental costs of electric vehicle battery production has no effect on willingness to donate money to an organization working against the destruction of natural ecosystems around the world"*.

Despite the coefficient for *T1* not being statistically significant, it is interesting to see that the control variable for political orientation[9] was (*coef* $= -0.399$, p-value $= 9.68e-06$). Moreover, similar to the previous model, having mainly environmental motivations to drive or wanting to drive an electric vehicle as main means of transportation also presented a statistically significant result (*coef* $= 1.610, p$-value $= 0.0431$).

6.3.4 Measurement 4

The twelfth (`dv3_4`) model used willingness to volunteer for an organization working to protect natural ecosystems around the world (`dv3_volunt`) as dependent variable. Similarly, the coefficient for *T1* (-0.163) indicated a small decrease in willingness to volunteer for such an organization. However, like in the previous two models, the coefficient was not statistically significant (p-value $= 0.72776$). Therefore, it was not possible to reject the following null sub-hypothesis: *"information about the socio-environmental costs of electric vehicle battery production has no effect on willingness to volunteer for an organization working against the destruction of natural ecosystems around the world"*.

It is worth pointing out that coefficients for control variables like the likelihood of volunteering for an organization working for a cause that matters to the respondent (*coef* $= 0.385$, p-value $= 4.82e-07$), and having mainly environmental motivations to drive or wanting to drive an electric vehicle (*coef* $= 2.195, p$-value $= 0.00195$) were statistically significant. That

[9]This variable (`left_right`) was measured by asking the respondents to place themselves on a scale from 1 to 11, where 1 meant "left" and 11 meant "right".

was also the case for the control variable for political orientation (`left_right`) was also statistically significant, albeit having the opposite effect per additional unit -which means, being closer to the right- (*coef* $= -0.217$, *p*-value $= 0.00339$).

After running the four models for *DV3* (i.e., willingness to be politically engaged), none of the null sub-hypothesis was rejected. Therefore, it is possible to conclude that there is no support for rejecting the general null hypothesis (*H3-null*) which states that *"information about the socio-environmental costs of electric vehicle battery production has no effect on willingness to be politically engaged"*. Nevertheless, the results are interesting for two other reasons. First, that last three models show the opposite to the expected effect (i.e., a decrease in willingness to be politically engaged). Second, that having mainly environmental motivations to drive or wanting to drive an electric vehicle as main means of transportation was statistically significant for those three models, indicating an increase in willingness to be politically engaged. Table 13 presents the most relevant coefficients of the ninth, tenth, eleventh, and twelfth models.

6.4 Additional Hypothesis 1: Explicit Mention of Solutions

For the first additional hypothesis, it was expected that providing explicit solutions to the socio-environmental costs of electric vehicle battery production would have a stronger effect on the dependent variables, compared to when solutions are not mentioned. Thus, it was necessary to look at the difference between the effects of *T1*, and the effects of *T2* and *T3*. However, it was not possible to find a consistent trend in the differences between the coefficients for *T1*, and those of *T2* and *T3*. While some models showed that *T2* and *T3* had a stronger effect than *T1*, some others showed than only one of them was stronger, that both had a weaker effect than *T1*, or that they had an opposite effect to *T1*.

In addition, the significance for those differences were assessed by re-running all the twelve models, but resetting the reference level to *T1*. Considering a significance level threshold of 0.05, none of the resulting coefficients for *T2* or *T3* were statistically significant. Therefore, there was no support for rejecting the additional null hypothesis (*H4-null*) stating that *"Regardless of if solutions are explicitly mentioned or not, the effect of information about the socio-environmental costs of electric vehicle battery production is the same on all the dependent vari-*

Table 13: Regression Table for Ninth, Tenth, Eleventh, and Twelfth Models

	Dependent variable:			
	dv3_learn 9th Model (dv3 1)	dv3_protest 10th Model (dv3 2)	dv3_donate 11th Model (dv3 3)	dv3_volunt 12th Model (dv3 4)
Political Orientation	−0.0002	−0.129**	−0.399***	−0.217***
	(0.075)	(0.062)	(0.087)	(0.073)
Environmental Att.	0.041	0.218***	0.162	0.087
	(0.092)	(0.076)	(0.107)	(0.090)
Justice Att.	0.270***	0.031	0.105	0.115
	(0.076)	(0.062)	(0.088)	(0.073)
Cosmopolitan Att.	0.097	0.148***	0.108	0.065
	(0.064)	(0.056)	(0.073)	(0.066)
EV Motivation (Env.)	0.283	2.004***	1.610**	2.195***
	(0.686)	(0.552)	(0.790)	(0.697)
T1	0.275	−0.256	−0.141	−0.163
	(0.487)	(0.397)	(0.557)	(0.469)
T2	0.398	−0.457	−0.765	−0.300
	(0.486)	(0.398)	(0.561)	(0.468)
T3	0.371	−0.226	−0.405	−0.229
	(0.502)	(0.411)	(0.583)	(0.484)
Control	8.362***	−1.458	4.770*	1.383
	(2.113)	(1.952)	(2.439)	(2.057)
Observations	211	209	209	208
R^2	0.332	0.647	0.401	0.489
Adjusted R^2	0.160	0.552	0.245	0.351
Residual Std. Error	2.256 (df = 167)	1.836 (df = 164)	2.605 (df = 165)	2.173 (df = 163)
F Statistic	1.928*** (df = 43; 167)	6.833*** (df = 44; 164)	2.573*** (df = 43; 165)	3.546*** (df = 44; 163)

Note: *p<0.1; **p<0.05; ***p<0.01

ables is the same.

6.5 Additional Hypothesis 2: Solution Framing

For the second additional hypothesis, it was expected that a political framing of the solutions to the socio-environmental costs of electric vehicle battery production would have a stronger effect on all the dependent variables, compared to a technological framing of those alternatives. Therefore, the analysis required a comparison between the effects of *T2* and *T3*. For this, the twelve models were ran again, but with *T3* set as the reference level.

Like in the case of the first additional hypothesis, the coefficients of the models run for *DV1* did not show a consistent trend in terms of which treatment had a stronger effect. On the contrary, opposite to what was expected, all the models run for *DV3* indicated than *T2* (i.e., technological framing) had a stronger effect than *T3* (i.e., political framing). Nevertheless, it is important to clarify that, with the exception of willingness to learn more about how and where electric cars are produced, the effects of *T2* and *T3* on the measurements of *DV3* were all negative, which was also opposite to what was expected. Unfortunately, despite the interesting findings, none of the coefficients for *T2* and *T3* were statistically significant in the models run for *DV1* and *DV3*.

In the models run for *DV2*, *T3* had a stronger effect than *T2*. This was the case for the likelihood of voting for a party that stands for policies which require electric vehicle producers to be more transparent about the source of their materials, and the likelihood of voting for a party which stands for subsidizing public transportation to make it more affordable instead of supporting incentives for electric vehicles to be cheaper to buy (although, it was a negative effect for this variable). However, like those in the models run for *DV1* and *DV2*, these coefficients were not statistically significant.

The only exception was found in the first measurement of *DV2*. Opposite to what was expected, as well as to the trend seen for the other measurements of *DV2*, *T2* had a stronger effect than *T3* regarding the likelihood of voting for a party that stands for policies which make electric vehicles cheaper to buy. Moreover, the coefficient for *T2* was statistically significant ($coef = 1.17595$, p-value $= 0.02986$). Therefore, it was possible to reject the specific null sub-hypothesis stating that *"Regardless of whether the solutions are communicated through a* *technological or a political framing, the effect of information about the socio-environmental costs of electric vehicle battery production is the same on the likelihood of voting for a party that stands for policies which make electric vehicles cheaper to buy"*. However, given that this was the only rejected null sub-hypothesis, it is possible to conclude that there was not enough support to reject the additional null hypothesis (*H5-null*) stating that *"regardless of whether the solutions are communicated through a technological or a political framing, the effect of information about the socio-environmental costs of electric vehicle battery production is the same on all the dependent variables"*

7 Discussion

Several interesting discussion points emerge from the results of the data analysis. One of them is that, leaving aside their statistical significance, the coefficients suggest that the effects of the treatments were not that strong in most of the dependent variables. I believe that this could be explained by the fact that Norway is a country in which electric mobility incentives have existed for decades. Therefore, Norwegians' attitudes towards electric vehicles might be more resilient than those of people living in countries, where the preference for electric mobilization is still not well established. However, it is important to keep in mind that the results could also be explained by the unsuccessful manipulation. The fact that, according to the manipulation check, about half of the respondents did not properly understand the framing of the solutions provided, could also be an explanation for the mostly inconclusive results about the effects of the solutions and the difference in the framing.

It is also worth noting that there were several cases in which the treatments had the opposite effect to what was expected. This was the case, for example, of the likelihood of voting for a party that stands for subsidizing public transportation instead of incentives which make electric vehicles cheaper to buy. It may be that the fact that all treatment groups were, on average, less likely than the control group to vote for such a party could be explained by the strength of economic motivations for electric vehicle ownership in Norway. Nevertheless, this outcome is still paradoxical, given that all the groups but *T2* were also less likely to vote for a party which stands for policies which make electric vehicles cheaper to buy. This suggests that it is worth exploring further, whether the presence of a trade-off in the measurement made the respondents evaluate their answers differently.

Another interesting case of opposite effects was the decrease in willingness to participate in all the political activities which measured *DV3*, except for learning more about the production of electric vehicles. Following the White et.al.'s research (2012), this could be explained by a failure to convey that the socio-environmental issues caused by lithium extraction can be *effectively*, and not only *potentially* tackled. Another explanation could be found in the geographical distance between Chile, and Norway, as well as to the lack of visual material that could have provide respondents with a more real picture of the social and environmental damage occurring in Chile. Nevertheless, in order to explore these additional factors, more information about the respondents' understanding of the treatment would need to be collected (e.g., how efficient do they think the solutions are, how bad the impacts of lithium extraction are, etc.)

Finally, it is hard to overlook that none of the null hypotheses, and only two null sub-hypotheses were able to be rejected. Nevertheless, the statistically significant coefficients found for justice, and cosmopolitan attitudes, as well as for environmental motivations for electric vehicle use, provide valuable clues for what needs to be considered in further research. Therefore, I believe that the obtained results suggests that the experiment should be tried again, with improved treatments, a bigger sample, a more detailed survey, and considering certain attitudes and motivations as more than just control variables.

8 Conclusion

Motivated by environmental justice concerns, the research question articulating this thesis was about the effects of information about the socio-environmental costs of electric vehicle battery production on attitudes towards electric vehicles, as well as on willingness to be politically engaged. To answer this question, an online experiment was designed and carried out in Norway, given their high percentage of electric vehicle adoption. The randomly assigned treatments provided the participants with different amounts of information, and used different framings to communicate them. The resulting dataset was analyzed with the use of twelve multiple linear models. However, the results were mostly inconclusive, as they led to the rejection of only two null sub-hypotheses.

There are two limitations which need to be considered. The main one was the manipulation, which was only partially successful. As mentioned in the discussion, this could be an alternative explanation for the obtained results. However, even if the effects had been stronger and the coefficients had been statistically significant, it would not be possible to reliably attribute them to the treatment. Therefore, the findings of this study should be taken as suggestive, not as conclusive The second important limitation was the sample, which was not only small but also not very representative of the Norwegian population. This is related to the shortcomings of using social media to distribute the survey, as well as the limited time and resources available.

Nevertheless, despite the limitations and the limited significant coefficients, this thesis is still relevant for the growing academic interest in critical approaches to electric mobility. One interesting, but unexpected finding, is that information about the socio-environmental costs of electric vehicle production consistently led to a *decrease* in all the measurements of willingness to be politically engaged but one. It is worth exploring the reason behind this counter-intuitive result, as well as if there is any explanation for why the decrease is not observed in the case of willingness to learn about where and how electric vehicles are produced. This suggests, moreover, that further research is needed to discover whether the paradoxical results for *DV3* are specific to the Norwegian population, or if it is a phenomenon that can be generalized to other countries.

Another unintended -although less paradoxical- findings were the statistically significant coefficients for cosmopolitan, environmental, and justice attitudes, as well as for having mainly environmental motivations for electric vehicle use. This thesis was not designed to inquire deeply into the effects of such attitudinal and motivational variables. Nevertheless, they should be more carefully considered in future research.

Finally, a one last research venue encouraged by this study is the replication of this experiment. The use of improved treatments, a more precise questionnaire, and a bigger sample would probably yield interesting results. Furthermore, the findings might vary considerably if the study is replicated in a country in which electric vehicles are less established, or even in Norway, if the existent economic incentives for electric vehicle adoption are modified. Future attempts of testing the effect of the information of socio-environmental costs of electric vehicle battery production on attitudes towards electric vehicles should consider the limitations of this thesis, in order to get better results.

Appendix A

Survey Questions in English

[I. Informed Consent]

Thank you for your interest in our study about attitudes towards electric vehicles. The survey will take about 10-15 minutes to complete. By completing the survey, you will have the opportunity to win a 1000kr Filmweb gift card. The winner will be randomly chosen on the last week of June. If you wish to participate in the lottery, you will have the option to provide an email address at the end of the survey. This will be used exclusively to contact you in case you won the prize. Your privacy is a priority for us. Therefore, the survey will not collect any personal information (besides the email, if voluntarily provided). Your responses will be kept completely anonymous and reported only in the aggregate. Due to academic requirements, the analysis and the dataset will be available online at the thesis repository of the Central European University in Vienna, Austria. However, no personal information will be published. You can choose not to answer any given question by selecting "I prefer not to say" and continue the survey. You can also decide to exit the survey at any time. The survey can only be answered once. Thank you very much! We highly appreciate your time and effort!

I have read the informed consent and voluntarily agree to participate in this study.

[Instruction]

"Some of the questions may be asked repeatedly. This is intentional. Please, do not skip them. Thank you!"

[II. Demographics]

1. What is your year of birth? Answer(A): Respondents wrote their birth year.
2. What is your gender? A: Female, Male, Other, I prefer not to say.
3. Which is your highest level of completed education? A: No completed education, Grunnskole (Mandatory education), Videregående (High school), Fagutdanning (Trade school), Universitet/Høgskole (including BA, MA, PhD, etc.) (University/College), I prefer not to say.
4. Sometimes we talk about different social groups or social classes. If you were to place yourself in a social class, which of these would it be? A: Underclass, Working class, Lower middle class, Middle class, Upper middle class, Overclass, I prefer not to say.
5. Which city do you live in? A: Oslo, Bergen, Stavanger, Trondheim, Other, I prefer not to say..
6. Which of these describes best the area where you live? We think here of Norwegian standards. A: A big city, Suburbs or outskirts of a big city, A small or medium-sized city, A village center, A sparesely populated area, I prefer not to say.

***[III. Political Ideology/Participation]**

7. In general terms, how interested in politics are you? A: Very interested, Interested, Somewhat interested, A little interested, Not interested, I prefer not to say.

8. In politics one often talks about "left" and "right". The following is a scale in which 1 represents the left, and 11 represents the right. How would you place yourself in such a scale? A: 11 item scale (1=left, 11=right)

9. Which party would you vote for if the parliamentary elections were tomorrow?

10. Hvilket parti ville du ha stemt på dersom det var stortingsvalg i morgen? A: Kristelig Folkeparti, Høyre, Fremskrittspartiet, Venstre, Sosialistisk Venstreparti, Senterpartiet, Miljøpartiet De Grønne, Arbeiderpartiet, Rødt, I do not want to vote, I would vote blank, I do not have the right to vote, Other party, I prefer not to say.

11. If there was a protest about a cause that matters to you this Sunday, how likely is it that you would participate? A: 11 item scale (1=Not likely at all, 11=Extremely likely)

12. If an organization working for a cause that matters to you was looking for volunteers, how likely is it that you would participate? A: 11 item scale (1=Not likely at all, 11=Extremely likely)

[IV. Control Variable - Environmental Attitudes]

12. How concerned are you about climate change? A: Not concerned at all, A little concerned, Somewhat concerned, Concerned, Extremely concerned, I prefer not to say.

13. Practices such as recycling, unplugging unused electronic devices, and minimizing water usage make our lifestyles more sustainable. In the following, there is a scale in which 1 means "not sustainable at all", and 11 means "extremely sustainable". Where would you place your lifestyle in such a scale? A: 11 item scale (1=Not sustainable at all, 11=Extremely sustainable)

14. Imagine you spend 1000kr on weekly groceries. How much more would you be willing to pay for your weekly groceries for they to include environmentally friendly products (e.g., reduced plastic, no pesticides, recycled packaging, etc.)? A: I would not pay more for such an option, Not more than 50kr more, Between 51kr and 100kr more, Between 101kr and 150kr more, Between 151kr to 200kr more, More than 201kr more, I prefer not to say.

[V. Control Variable – Justice/Cosmopolitan Attitudes]

15. Imagine that you and four other colleagues have presented an excellent report. You were all part of the same team and have worked equally hard. However, your boss decides to give a salary bonus only to you and one more teammate. How likely is it that you would ask the boss to give the salary bonus to the whole team? A: 11 item scale (1=Not likely at all, 11=Extremely likely)

16. Imagine that you and four other colleagues have been told to work together on a report. You are all equally skilled and have the same time availability. However, two of your teammates have received a higher workload than the rest. How likely is it that you would ask for a more equal distribution of the workload? A: 11 item scale (1=Not likely at all, 11=Extremely likely)

17. How much do you enjoy watching TV shows or reading about cultures and countries different than yours? A: 11 item scale (1=I do not enjoy it at all, 11=I enjoy it a lot)

18. If there was a free event presenting cuisines, music and dance from other countries this Sunday in your city, how likely is it that you would attend? A: 11 item scale (1=Not likely at all, 11=Extremely likely)

[VI. Control Variable – EV Use and Transportation Means]

19. Usually, what is your main means of transportation? A: Personal fossil-fuel car, Personal electric car (including battery electric vehicles, plug-in hybrid electric vehicles, hybrid electric vehicles, and full cell electric vehicles), Other electric vehicles such as e-bikes and e-scooters, Bicycle, Public transportation, Other, I prefer not to say.

20. Are you willing to buy an electric vehicle in the near future? [Iff Q19 IS NOT "personal electric vehicle"] A: Yes, Maybe, No, I prefer not to say.

21. What is your main motivation for having or wanting to have an electric car as main means of transportation? [Iff Q19 IS "personal electric vehicle" OR (Q19 IS NOT "personal electric vehicle" AND (Q20 IS "yes" OR "maybe"))] A: Financial (e.g., economic incentives such as tax exemptions, reduced fuel costs, etc.), Environmental (e.g., reduced carbon emissions, reduced air and noise pollution, etc.), Technological (e.g., enthusiasm for the development of new technologies, etc.), Practical (e.g., occupies less space, easier to avoid traffic jams, etc.), Other, Prefer not to say

22. What is your main motivation for maintaining your usual main means of transportation? [Iff Q19 IS NOT "personal electric vehicle" AND Q20 IS "no"] A: Financial (e.g., economic incentives such as tax exemptions, reduced fuel costs, etc.), Environmental (e.g., reduced carbon emissions, reduced air and noise pollution, etc.), Technological (e.g., enthusiasm for the development of new technologies, etc.), Practical (e.g., occupies less space, easier to avoid traffic jams, etc.), Other, Prefer not to say

23. On a scale from 1 to 11, how happy are you with your usual main means of transportation? A: 11 item scale (1=Not happy at all, 11=Extremely happy)

24. On a scale from 1 to 11, how willing would you be to change your usual main means of transportation? A: 11 item scale (1=Not willing at all, 11=Extremely willing)

[VII. Independent Variable – Treatments] These are provided later, under "Treatments".
[VIII. Manipulation Checks]

24. Has the text provided you with new information electric vehicles? [For all the groups] A: Yes, No, I prefer not to say.

25. In which countries is more than 50% of the world's lithium resources concentrated? [For T1, T2, and T3] A: Norway, Sweden, and Denmark, China, Japan, and Korea, Australia and New Zealand, Argentina, Bolivia, and Chile, I don't know, I prefer not to say.

26. Which percentage of water is being used in Chile's "Salar de Atacama" region for lithium mining? [For T1, T2, and T3] A: 0%, 10%, 65%, 100%, I don't know, I prefer not to say.

27. According to the text, whose efforts are crucial for reducing the impacts of lithium mineral extraction? [For T1, T2, and T3] A: Scientists, Citizens and consumers, The article does not mention this, I don't know, I prefer not to say.

[IX. Dependent Variable – Attitudes Towards Transportation Means]

28. On a scale from 1 to 11, how happy are you with your usual main means of transportation? [Diff-in-diff] A: 11 item scale (1=Not happy at all, 11=Extremely happy)
29. On a scale from 1 to 11, how willing would you be to change your usual main means of transportation? [Diff-in-diff] A: 11 item scale (1=Not willing at all, 11=Extremely willing)
30. Imagine that your friend plans to buy a new car and asks for your advice. How likely is it that you would recommend them to buy an electric vehicle? A: 11 item scale (1=Not likely at all, 11=Extremely likely)

[X. Dependent Variable – Attitudes Towards EV Policy]

31. If the parliamentary elections in Norway were tomorrow, how likely is it that you would vote for a party that supports stands for policies which make electric vehicles cheaper to buy (e.g., sales tax exemption)? A: 11 item scale (1=Not likely at all, 11=Extremely likely)
32. If the parliamentary elections were tomorrow, how likely is it that you would vote for a party that stands for policies that require electric vehicle producers to give information about the origin of their supplies (e.g., a "fair trade" label)? A: 11 item scale (1=Not likely at all, 11=Extremely likely)
33. If the parliamentary elections were tomorrow, how likely is it that you would vote for a party that stands for subsidizing the price of public transportation tickets instead of incentives that make electric vehicles cheaper to buy? A: 11 item scale (1=Not likely at all, 11=Extremely likely)

[XI. Dependent Variable – Political Participation]

34. On a scale from 1 to 11, how willing would you be to learn more about how and where electric vehicles are produced? A: 11 item scale (1=Not willing at all, 11=Extremely willing)
35. On a scale from 1 to 11, how willing would you be to participate in a protest against the destruction of natural ecosystems around the world, were it to take place this Sunday? A: 11 item scale (1=Not willing at all, 11=Extremely willing)
36. On a scale from 1 to 11, how willing would you be to donate money to an organization working to protect natural ecosystems around the world? A: 11 item scale (1=Not willing at all, 11=Extremely willing)
37. On a scale from 1 to 11, how willing would you be to volunteer for an organization working to protect natural ecosystems around the world? A: 11 item scale (1=Not willing at all, 11=Extremely willing)

[XII. Last Manipulation Check]

38. On a scale in which 1 means "not sustainable at all" and 11 means "extremely sustainable", how would you rate electric vehicles? A: 11 item scale (1=Not sustainable at all, 11=Extremely sustainable)

39. On a scale in which 1 means “not ethical at all” and 11 means “extremely ethical”, how would you rate electric vehicles? A: 11 item scale (1=Not ethical at all, 11=Extremely ethical)

[Email]

40. If you wish to participate in the gift card lottery, please write your email address below. Please, make sure that it is the correct email address, as this will be used to contact the winner.

Thank you very much for completing the survey. We really appreciate your time and effort!

Treatments

Control Group

“In the face of a worsening climate crisis, the surge in electric vehicles has been welcomed with optimism. While in 2016 there were only 1 million electric vehicles on the road, they are expected to reach the 20 million milestone by mid 2022 (McKerracher 2022). A remarkable step towards greener and healthier societies!”

*The reference list with the cited works will be provided at the end of the survey.

Treatment Group 1

“ “In the face of a worsening climate crisis, the surge in electric vehicles has been welcomed with optimism. While in 2016 there were only 1 million electric vehicles on the road, they are expected to reach the 20 million milestone by mid 2022 (McKerracher 2022). A remarkable step towards greener and healthier societies!

However, electric vehicles are costly. The extraction of minerals like lithium, an important component of EV batteries, causes environmental and social problems in lithium-rich countries. A main problem is that the extraction of lithium demands an excessive amount of water. For example, 65% of the water supply of Chile’s “Salar de Atacama” region is being used for lithium extraction (UN 2020). This has brought landscape damage, as well as soil and groundwater contamination, forcing local population out of their ancestral lands (UN 2020). With the rise of EVs, the demand of lithium is expected to increase by about 600% within the next 10 years (Mitchell 2021), so this situation could even worsen.

In addition, more than 50% of the global lithium resources are concentrated in Argentina, Bolivia, and Chile (UNCTAD 2020). This results in an unfair distribution of the costs and benefits of electric mobility. That is, while some countries can enjoy the benefits from reduced pollution of EVs, others must deal with the environmental and social problems related to the production of EV batteries”.

*The reference list with the cited works will be provided at the end of the survey”

Treatment Group 2

“In the face of a worsening climate crisis, the surge in electric vehicles has been welcomed with optimism. While in 2016 there were only 1 million electric vehicles on the road, they are expected to reach the 20 million milestone by mid 2022 (McKerracher 2022). A remarkable step towards greener and healthier societies!

However, electric vehicles are costly. The extraction of minerals like lithium, an important component of EV batteries, causes environmental and social problems in lithium-rich countries. A main problem is that the extraction of lithium demands an excessive amount of water. For example, 65% of the water supply of Chile’s “Salar de Atacama” region is being used for lithium extraction (UN 2020). This has brought landscape damage, as well as soil and groundwater contamination, forcing local population out of their ancestral lands (UN 2020). With the rise of EVs, the demand of lithium is expected to increase by about 600% within the next 10 years (Mitchell 2021), so this situation could even worsen.

In addition, more than 50% of the global lithium resources are concentrated in Argentina, Bolivia, and Chile (UNCTAD 2020). This results in an unfair distribution of the costs and benefits of electric mobility. That is, while some countries can enjoy the benefits from reduced pollution of EVs, others must deal with the environmental and social problems related to the production of EV batteries.

To address this problem, dependence on these minerals must be reduced (UN 2020). Research on alternative batteries with materials such as silicon and iron will be crucial for this (Campbell 2022). Therefore, scientists and engineers need to prioritize the development of technologies based on abundant elements! (Campbell 2022)”.

*The reference list with the cited works will be provided at the end of the survey.

Treatment Group 3

“In the face of a worsening climate crisis, the surge in electric vehicles has been welcomed with optimism. While in 2016 there were only 1 million electric vehicles on the road, they are expected to reach the 20 million milestone by mid 2022 (McKerracher 2022). A remarkable step towards greener and healthier societies!

However, electric vehicles are costly. The extraction of minerals like lithium, an important component of EV batteries, causes environmental and social problems in lithium-rich countries. A main problem is that the extraction of lithium demands an excessive amount of water. For example, 65% of the water supply of Chile’s “Salar de Atacama” region is being used for lithium extraction (UN 2020). This has brought landscape damage, as well as soil and groundwater contamination, forcing local population out of their ancestral lands (UN 2020). With the rise of EVs, the demand of lithium is expected to increase by about 600% within the next 10 years (Mitchell 2021), so this situation could even worsen. In addition, more than 50% of the global lithium resources are concentrated in Argentina, Bolivia, and Chile (UNCTAD 2020). This results in an unfair distribution of the costs and benefits of electric mobility. That is, while some countries can enjoy the benefits from reduced pollution of EVs, others must deal with the environmental and social problems related to the production of EV batteries.

To solve this problem, dependence on these minerals must be reduced (UN 2020). Consumers and citizens can play a crucial role. They can choose alternative transportation methods like walking and cycling, and demand public policies that reduce our dependency on cars. They can also support electric vehicle regulations that would make producers pay more attention to ethical and environmental consequences".

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Pictures

Figure 8: Picture of ad settings on Facebook

Figure 9: Picture of Facebook post used to distribute the survey

Figure 10: Results of the paid Facebook ad

Figure 11: Picture of the Reddit post used to distribute the survey

Figure 12: Picture of the informed consent displayed in the survey

Appendix B

Figure 13: Complete regression table for first model (dv1_1ev)

Figure 14: Complete regression table for second model (dv1_1no_ev)

Figure 15: Complete regression table for third model (dv1_2ev)

Figure 16: Complete regression table for fourth model (dv1_2no_ev)

Figure 17: Complete regression table for fifth model (dv1_3)

Figure 18: Complete regression table for sixth model (dv2_1)

Figure 19: Complete regression table for seventh model (dv2_2)

Figure 20: Complete regression table for eighth model (dv2_3)

Figure 21: Complete regression table for ninth model (dv3_1)

Figure 22: Complete regression table for tenth model (dv3_2)

Figure 23: Complete regression table for eleventh model (dv3_3)

Figure 24: Complete regression table for twelfth model (dv3_4)

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